

REMARKS

Claims 2, 7 and 10-27 remain pending. Independent claims 2, 7, 13 and 19 have been amended to distinguish over the prior art of record. No new matter was added. Accordingly, Applicants respectfully submit that the rejections have been overcome and that the present application is in condition for allowance.

I. Claim Rejections – 35 USC §102(b)/§103(a)

- A. *In the non-final Office Action dated July 31, 2008, claims 2 and 10-24 are rejected under 35 USC §102(b) as being anticipated by or, in the alternative, under 35 USC §103(a) as being obvious over JP 2003-192346.*
- B. *In the non-final Office Action dated July 31, 2008, claims 2 and 10-24 are rejected under 35 USC §102(b) as being anticipated by or, in the alternative, under 35 USC §103(a) as being obvious over JP 2001-039713.*

The following arguments apply for each of the above referenced rejections. The cited references, JP ‘346 and JP ‘713, are both directed to tellurite glass fiber. Machine-prepared, full, English language translations are provided for each reference in the Supplemental Information Disclosure Statement filed herewith.

Turning first to the claims of the present application, independent claims 2, 13 and 19 have each been amended to require the zinc oxide powder, sputtering target, and thin film to have a content of Na of 1wtppm or less and a content of K of 1wtppm or less. No new matter was added. For example, see the present application, as filed, on: page 8, lines 10-11; page 9, lines 10-12; and page 6, Table 1 (see Na and K impurities amount in wtppm).

The present invention converts at low cost a relatively inexpensive zinc-containing scrap raw material having a purity level of only about 90wt% (1N) to zinc oxide of 99.999wt% (5N)

purity or more. For example, see the present application, as filed, on: page 4, line 16; page 4, line 26, to page 5, line 4; page 6, Table 1 (raw material column); page 8, lines 12 and 27; and page 9, line 12. In the present invention, the highly pure zinc oxide powder is intended for use in making a sputtering target which, in turn, is used to form thin films via a sputtering operation. The thin film of the present invention is for use in electronic devices, such as semiconductors. As such, the inclusion of alkali metals, such as sodium (Na) and potassium (K), cannot be tolerated since the presence of Na, K, or other alkali metals will significantly deteriorate the desired electrical properties of the thin film.

Table 1 of the present application indicates that the scrap raw material includes about 80wtppm of Na and about 5wtppm of K and that each of Na and K should be reduced to 1wtppm or less, or more preferably, 0.1wtppm or less. See page 8, lines 10-12, and page 9, lines 10-12, of the present application, as filed. Also, see Table 1 on page 6 which discloses Na content in Examples 1-3 of the present invention of 0.2wtppm, or less than 0.1wtppm, and K content of 0.3wtppm, or less than 0.1wtppm.

Page 8, lines 5-7, of the present application, as filed, discloses that the “use of sodium hydroxide or potassium hydroxide is undesirable since high concentrations of Na and K will be respectively mixed in the zinc oxide.” Also, Comparative Example 3 discussed on page 12, line 18, to page 13, line 6, of the present application specifically discloses a process that uses sodium hydroxide. Table 2, page 11, indicates that the Na content of the scrap raw material of 80wtppm increases to 150wtppm during the purification process of Comparative Example 3. This increase is explained on page 13, lines 4-5, of the present application as being the result of neutralization with NaOH.

Turning to the cited prior art, the English translations of JP '346 and JP '713 are clearly directed to the use of zinc oxide in a composition for forming a tellurite glass fiber used as an optical amplification medium in a light amplifier and laser device. See Paragraph Nos. 0001 and 0002 of each of JP '346 and JP '713. This glass fiber material includes sodium oxide as a main ingredient. See Paragraph Nos. 0006, 0019, and 0038 of JP '346 and 0022, 0027 and 0036 of JP '713.

The processes of JP '346 and JP '713 begin with the use of an expensive zinc material having 5N purity or more to start, and the processes do not include solvent extraction and activated carbon treatment. See Paragraph No. 0012 of JP '346 and Paragraph No. 0010 of JP '713. Thus, unlike the present invention which uses inexpensive scrap material and converts the scrap material at low cost into highly pure zinc oxide, JP '346 and JP '713 begin with an expensive highly pure zinc raw material of 5N or greater to obtain an oxide.

The process of JP '346 uses sodium hydroxide or potassium hydroxide for neutralization. See Paragraph Nos. 0010, 0015, and 0026 of JP '346. The process of JP '713 uses sodium carbonate or sodium bicarbonate. See Paragraph Nos. 0008, 0009, 0012, 0014, 0016, 0023, and 0029 of JP '317. Since the tellurite glass of JP '346 and JP '713 contains Na₂O, there is no common sense reason for limiting the inclusion of Na or K, and neither JP '346 nor JP '713 provide any disclosure relative to limiting Na or K concentration.

Nevertheless, as evident from Comparative Example 3 and the statement on page 8, lines 5-7, of the present application, as filed, the content of Na or K in the powder will increase if sodium hydroxide, potassium hydroxide, sodium carbonate, or sodium bicarbonate is used in the process of JP '346 and JP '713.

Accordingly, Applicants respectfully request reconsideration and removal of the above referenced rejections because JP '346 and JP '713 fail to teach or render obvious the powder, sputtering target, and thin film required by the claims 2 and 10-24 of the present application which require greatly reduced amounts of Na and K content.

Further, Applicants respectfully submit that claims 2 and 10-24 of the present application are not obvious in view of JP '346 and JP '713 because JP '346 and JP '713 teach away from the present invention since JP '346 and JP '713 require use of sodium hydroxide, potassium hydroxide, sodium carbonate, or sodium bicarbonate and Na is taught as being a "main ingredient" (not an impurity) by these references. Thus, there is no common sense reason for reducing Na and K content in the materials disclosed by JP '346 and JP '713.

For these reasons, Applicants respectfully submit that claims 2 and 10-24, as amended, are patentable over the JP '346 and JP '713 references.

C. *In the non-final Office Action dated July 31, 2008, claims 2, 7 and 10-27 are rejected under 35 USC §102(e) as being anticipated by or, in the alternative, under 35 USC §103(a) as being obvious over U.S. Patent Application Publication No. 2007/0193413 A9 of Harlamovs et al.*

Turning first to independent method claim 7 of the present application, it has been amended to require a method of manufacturing zinc oxide powder including the steps of subjecting Zn-containing scrap to acid leaching with nitric acid or electrolytic extraction with ammonium nitrate solution. Thereafter, solvent extraction and activated carbon treatment are performed thereto to remove impurities. The resultant solution is neutralized with ammonium hydroxide to obtain zinc hydroxide, and the zinc hydroxide is fired to obtain zinc oxide. No new matter was added. The use of nitric acid is disclosed on page 8, lines 1-2, and page 9, line 1, of

the present application, as filed. The use of ammonium nitrate solution is disclosed on page 9, lines 26-28, and page 10, lines 3-5, of the present application, as filed, and the use of ammonium hydroxide is disclosed on page 8, lines 3-5, of the present application, as filed.

In contrast, Harlamovs et al. disclose a process of obtaining zinc from mineral sulfide via bioleaching. (See Paragraph No. 0001 of the Harlamovs et al. publication.) The neutralization process of Harlamovs et al. uses limestone (calcium carbonate), is performed immediately after the leaching process, and aims to eliminate Fe impurity. (See Paragraph No. 0083 of the Harlamovs et al. publication.) In addition, the processing fluid of the leaching process to the final electro-winning process is sulfuric acid.

The configuration and condition of the process steps of Harlamovs et al. discussed above are considerably different from that of claim 7, as amended, of the present application. For example, claim 7 of the present application requires the use of zinc containing scrap as the starting raw material (not mineral ore), performs leaching with nitric acid (not sulfuric acid), and performs neutralization using ammonium hydroxide (not calcium carbonate).

Further, with respect to specifically producing zinc oxide (instead of zinc), Harlamovs et al. requires the steps of treating a part of its purified solution to produce zinc carbonate and then calcinating the zinc carbonate to produce zinc oxide. (See Paragraph No. 0101 of the Harlamovs et al. publication.) Of course, such a process is fundamentally different from the process required by independent claim 7, as amended, of the present application which includes the steps of obtaining zinc hydroxide via neutralization and heats the zinc hydroxide to obtain zinc oxide.

Accordingly, Applicants respectfully submit that the process required by claim 7, as amended of the present application is both novel and non-obvious relative to the Harlamovs et al. publication. The cited publication teaches away from the steps of leaching with nitric acid,

performing neutralization with ammonium hydroxide, obtaining zinc hydroxide via neutralization, and heating the zinc hydroxide to obtain zinc oxide.

Turning to claims 2 and 10-24 of the present application, which are directed to a zinc oxide powder, sputtering target, and thin film, the composition required by independent claims 2, 13 and 19, as amended, is clearly different and non-obvious relative to that produced by the process disclosed in the Harlamovs et al. publication.

The required use of sulfuric acid in the process of Harlamovs et al. would clearly result in greater sulfur (S) content than that required by claims 2, 13 and 19 of the present application. Claims 2, 13 and 19 requires S content, excluding gas components, to be less than 10wtppm and the S content as gas component to be less than 100wtppm.

Harlamovs et al.'s required use of limestone (calcium carbonate) for neutralization and the required steps of first producing zinc carbonate and then calcinating the zinc carbonate to produce zinc oxide would clearly result in significantly greater calcium (Ca) and carbon (C) content and sulfur (S) content than that of the zinc oxide of the present invention. For example, independent claims 2, 13 and 19 of the present application each requires C content, excluding gas component, to be less than 10wtppm and C content as a gas component to be less than 100wtppm.

For these reasons, Applicants respectfully submit that claims 2 and 10-24 are novel and non-obvious relative to the zinc oxide of the Harlamovs et al. publication. Applicants respectfully request reconsideration and removal of the rejection of all claims, 2, 7 and 10-27.

D. In the non-final Office Action dated July 31, 2008, claims 2, 7 and 10-27 are rejected under 35 USC §103(a) as being obvious over U.S. Patent No. 4,572,771 or 4,610,722 issued to Duyvesteyn et al. in view of U.S. Patent No. 6,338,748 B1 issued to Lee et al. and further in view of U.S. Patent No. 6,361,753 B1 issued to Cashman.

Each of the Duyvesteyn et al., Lee et al., and Cashman et al. patents discloses hydrometallurgy processes of obtaining metallic zinc from zinc-containing furnace dust.

Duyvesteyn et al. require zinc to be collected from a hydrochloric acid or combination sulfuric acid-hydrochloric acid leaching solution via solvent extraction. According to the '771 Duyvesteyn et al. patent, "the leach liquor has to be neutralized with lime" (see column 7, line 42, of the '771 Duyvesteyn et al. patent).

Lee et al. require zinc to be collected by way of electro-winning. For example, see column 5, lines 37-40, of the Lee et al. patent which states "to operate an electrolytic extraction cell safely, zinc has to be collected in an electrodeposition step 40".

Cashman et al. require zinc to be obtained from a leached zinc chloride solution based on the reaction of Ca(OH)₂.

Accordingly, all of these processes are different relative to the process required by claim 7, as amended, of the present application. For example, claim 7, as amended, requires a method of manufacturing zinc oxide powder (not metallic zinc) and includes the step of subjecting Zn-containing scrap to acid leaching with nitric acid or electrolytic extraction with ammonium nitrate solution. Neither the use of nitric acid nor the use of ammonium nitrate solution is disclosed by the cited references. Solvent extraction and activated carbon treatment are thereafter performed to remove impurities. The resultant solution is neutralized with ammonium hydroxide to obtain zinc hydroxide, and the zinc hydroxide is fired to obtain zinc oxide. None of the cited references disclose use of ammonium hydroxide or the steps for obtaining zinc oxide.

For these reasons, Applicants respectfully submit that one of ordinary skill in the art cannot arrive at the process claimed in claims 7, 26 and 27 of the present application based on any combination of the Duyvesteyn et al., Lee et al., and Cashman et al. patents. Thus, Applicants respectfully submit that independent method claim 7, as amended, and dependent claims 26 and 27 are patentable over the cited combination.

In addition, based on the various process steps disclosed by these references, Applicants respectfully submit that a zinc oxide powder of the purity required by independent claims 2, 13 and 19 could not be produced based on any combination of the Duyvesteyn et al., Lee et al., and Cashman et al. patents. For example, Duyvesteyn et al. require the use of sulfuric acid and/or hydrochloric acid and neutralization with lime (calcium carbonate) and Cashman et al. requires use of zinc chloride solution. Also, these references all produce metallic zinc, not zinc oxide. Thus, Applicants respectfully submit that claims 2 and 10-24 are also patentable over the cited combination.

Accordingly, Applicants respectfully request reconsideration and removal of the above referenced rejection.

II. Conclusion

In view of the above amendments and remarks, Applicants respectfully submit that the rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

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